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Flora of the East Slope of the Cascade Mountains, in Crook County, Oregon

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FLORA OF THE EAST SLOPE OF THE CASCADE MOUNTAINS, IN CROOK COUNTY, OREGON.

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In the latter part of June, 1914, the writer joined a company of biological investigators and collectors, working under the general direction of Mr. Vernon Bailey, field naturalist of the U. S. Biological Survey, on a trip across the Cascade mountains, by way of the McKenzie Pass. The purpose of the expedition was to secure certain zoological and botanical data and specimens of the animal and plant life of the region, with a view to determining the life zones of this section of Oregon, as well as to add material to the collections of the several institutions represented by the members of the party.

The McKenzie Pass crosses the Cascades nearly due east of Eugene, where McKenzie river enters the Willamette. Eugene is not far from the center of the state north and south, and about fifty miles from the coast.

We left Eugene on June 27, and traveled by stage up the valley of the McKenzie for fifty miles, to McKenzie Bridge, where we remained for some time. The last third of this distance led through the heavy coniferous forest characteristic of the western slope of the Cascades. Much of this has now been cut off.

It may be well, for the sake of comparison, to touch upon some of the main features of the flora of the western slope and the summit before considering that of the eastern slope, in order to bring out more clearly the remarkable contrast due to the difference in precipitation.

The elevation at McKenzie Bridge is about 500 meters, the annual precipitation 1743 mm., a considerable part of which is snow. The flora is almost typically Transition, resembling in the main that of the Willamette Valley, but the presence of such species as *Thuja plicata, Tsuga heterophylla, Echinopanax horridum, Pyrola bracteata, Arctostaphylos tomentosa, Gaultheria shallon,* and several others, give it something of the Humid Transition or coastal slope character. There is also an admix-

ture of true Canadian forms, though these do not comprise a very large part of the total number. Such are *Pinus monticola, Clintonia uniflora, Tiarella unifoliata, Chimaphila umbellata, Pentstemon fruticosa,* and *Senecio triangularis.* The dense forests that cover most of this region are made up of *Pseudotsuga mucronata* (comprising at least half of the total bulk), *Thuja plicata, Abies grandis, Tsuga heterophylla, Pinus monticola,* and an occasional *Pinus lambertiana.* There are numerous unforested slopes and ridges, mostly supporting a dense growth of shrubs of various species. Along the banks of the river is an abundant growth of *Taxus brevifolia, Alnus oregana,* and *Acer circinatum.*

From McKenzie Bridge a three days' trip was made to Horse Pasture Mountain, ten miles to the southwest. This mountain has an elevation of about 2000 meters. The sides are mainly forested but the summit is mostly bare of trees and carries the flora quite through the Canadian zone, which is represented by a long list of species. Near the summit occurs *Tsuga mertensiana* and several other typically Hudsonian forms.

From McKenzie Bridge to the summit of the Cascades by way of the McKenzie Pass is about twenty miles. The road follows the canyon of Lost creek, a tributary of the McKenzie. Most of the way of ascent is gradual. Nearly half of the distance is through the usual dense forest, but the eastern half is through a more open region, mostly covered with undergrowth and intersected by sharp ridges and peaks with numerous slides of black porous lava. The elevation at the summit is approximately 1600 meters.

The flora at this point is high Canadian, about equivalent to that found at the top of Horse Pasture Mountain, where the elevation was somewhat greater. The divide does not form a sharply defined ridge, but there is a considerable area of moderately level country, with occasional shallow ponds, furnishing suitable conditions for a great variety of plant life. For the most part, the forest is not dense. The dominant tree is *Pinus contorta,* with a considerable abundance of *Pinus monticola, Tsuga mertensiana, Abies nobilis,* and in places, *Pseudotsuga mucronata* and *Picea engelmanni.* Deciduous trees are wanting and shrubs are small and not abundant. The latter are: one or two species of *Salix, Ribes lacustre, Spiraea densiflora, Pyrus sitchensis, Gaultheria ovatifolia, Vaccinium scoparium, and V. macrophyllum.* Among herbaceous plants, species of *Carex, Ra-*

nunculus, Delphinium, Saxifraga, Viola, Epilobium, Pentstemon, Mimulus, Pedicularis, and *Arnica,* are especially in evidence. *Pinus contorta* is abundantly infested with a diminutive mistletoe, *Razoumofskya americana.*

While encamped in this neighborhood, several days were spent investigating the plant and animal life of one of the Three Sisters, which are among the highest peaks in the Cascades of Oregon. The three mountains are in close proximity to each other, and retain sufficient snow to support several glaciers. The summit of the Middle Sister is about six miles from the nearest point on the road we were following. This is the only one of the three peaks visited. The flanks of the mountain in many places are fashioned into exceedingly rough and precipitous ridges and chasms by volcanic action, some of the lava flows being so recent as scarcely to support any vegetation. In other places, however, the slope is more gentle and even, and there is a good layer of soil.

As one begins the ascent from the 1600-meter elevation where we were encamped, the character of the vegetation is seen to change rapidly. *Pinus contorta* and *Abies nobilis* begin to thin out, and *Tsuga mertensiana* soon becomes the dominant conifer. A great variety of Hudsonian plants appear, at first as scattered individuals, but becoming more and more numerous. At about 2000 meters there is a fine pure growth of *Tsuga mertensiana,* with the ground beneath almost entirely devoid of smaller plants. When this has been passed the trail crosses several of the rough steep lava ridges, where *Pinus contorta* and *P. monticola* barely persist and just reach the lower limit of *Pinus albicaulis.*

Having crossed the last of the lava ridges, one finds himself on the bank of a tumbling torrent of milky water that issues from a glacier some two miles farther up the slope. The true Hudsonian zone is now reached. Here are growing in abundance *Juncoides piperi, Salix commutata, Pulsatilla occidentalis, Ranunculus eschscholtzii, Mitella pentandra, Lutkea pectinata, Potentilla flabellifolia, Lupinus alpicola, Phyllodoce empetriformis, Cassiope mertensiana, Valeriana sitchensis,* and *Agoseris alpestris.* This is within 400 to 500 meters of the forest line, and at the date of our visit, July 15, considerable areas were still covered with deep drifts of snow, that grew more extensive

as we advanced. At the forest line most of the above named species are still abundant, together with several others that belong more properly to the Arctic zone.

It should be noted that at this elevation, about 2500 meters, where *Tsuga mertensiana* and *Pinus albicaulis* dwindle down into low gnarled shrubs, there may be found open southward slopes, where certain Canadian plants, or even of lower zones, can maintain an existence, such as *Pinus contorta, Ribes cereum,* and *Spiraea densiflora.* This, of course, is saying merely that the life zones are not necessarily altitudinal zones, but are of a somewhat isothermal character.

The species most characteristic of the Arctic zone, that is, those occurring more or less plentifully at 2700 meters and upward and not found abundantly below timber line are, *Anemone hudsoniana, Oxyria digyna, Draba aureola, Phyllodoce glandulifera, Collomia debilis, Sibbaldia cuneifolia, Erigeron compositus,* and an undetermined *Senecio.* In addition to these, a number of species plentiful in the upper Hudsonian were also found,—*Carex straminiformis, C. breweri, Polygonum newberryi, Erigonum pyrolaefolium, Spraguea umbellata, Saxifraga tolmiei, Phyllodoce empetriformis, Pentstemon menziesii davidsonii,* and *Antennaria media.* It was too early in the season to study the Arctic flora to good advantage, as comparatively very little of the ground lying well within this zone was uncovered by snow. The mountain, moreover, is relatively young, and the soil above timber line is so scanty that it cannot support a very copious vegetation.

From this very brief account some idea may be gained of the altitudinal limits of the several life zones represented in this section of the Cascades, and of a few of the most characteristic species of each. From this region of copious moisture we will now pass on to a somewhat more detailed consideration of the plants of the eastern slope, where, within a few miles, we encounter an enormous decrease in the precipitation.

We started eastward again on July 19, and soon came to the edge of a vast lava field, which, spread out before us in black and rugged desolation, presented a truly remarkable geological spectacle. Two or three of the craters from which the most recent flows had issued could be made out easily. The dark jagged blocks of lava were tilted and tumbled in the wildest confusion, apparently just as they were left when first split and upheaved by the movement of the deeper and more fluid

portion of the mass. The rough surfaces of the blocks showed scarcely a sign of weathering, and vast areas were almost utterly destitute of vegetation; only very rarely could be seen a low stunted specimen of *Pinus contorta.* But there are older flows also, as at least three different periods of volcanic activity are represented. The more recent flows have followed the depressions in the older, islanding a number of elevations which are fairly well covered with vegetation. The width of this lava field where the road crosses it is, perhaps, between four and five miles. At its eastern edge, at an elevation of about 1500 meters, is a small canyon with abundant moisture where several Hudsonian species were found, among them *Phyllodoce empetriformis* and *Valeriana sitchensis.*

The flora of the east slope of the Cascades may be regarded as beginning at the eastern edge of these lava fields, which also form the eastern edge of the divide. Within a distance of three or four miles we descend into the Arid Transition. For thirty miles we have been ascending very gradually through a mesophytic flora from pure Transition to high Canadian, and the change, as we drop within an hour into the Arid Transition, is most striking. This seems all the more remarkable from the fact that there is no steep descent. In the eight or ten miles we have covered (somewhat less than this in a straight line) in passing from the summit into the Arid Transition zone, we have descended scarcely more than 300 meters, and beyond this there is little general eastward slope. McKenzie Pass is, of course, one of the lowest points in the great Cascade divide, yet the drop to the general level is nowhere as great as we might expect to find, for the whole of central Oregon is a plateau region from 1000 to nearly 2000 meters in elevation.

Our road follows the edge of the lava for some distance and *Pinus contorta, Abies nobilis* and *Tsuga mertensiana* continue to be the dominant conifers, but soon we come upon scattered specimens of yellow pine, *Pinus ponderosa,* and *Pseudotsuga mucronata* appears and suddenly becomes abundant; it seems to form, however, a remarkably narrow zone for a species ordinarily of such wide altitudinal range. With the increase of the yellow pine the other conifers thin out, though maintaining a sporadic distribution for two or three miles; finally they quite disappear, and for five or six miles we ride through a practically pure growth of yellow pine.

The yellow pine forest has a wholly different aspect from the coniferous forests that clothe the western slope. The trees stand far apart, their trunks are relatively stout, their tops broad and rounded, their foliage thin. They are clothed with no luxuriant growth of mosses and lichens, but the older trunks especially have a clean-cut appearance and are of a rich cinnamon color. No less conspicuous is the almost total lack of undergrowth of every description. One shrub, *Arctostaphylos manzanita,* does occur here and there, and one herbaceous plant, *Horkelia fusca,* but otherwise the thin sandy soil is covered only by a bed of dry pine needles. It is possible that there is a limited amount of short-lived spring herbage of which no trace could be seen while merely riding through in mid-summer.

For a long distance we pass no spring or stream, but as we draw near to the little town of Sisters we cross an irrigation ditch, the water of which is derived from Squaw creek. The forest now becomes more open and interrupted. Sagebrush, *Artemisia tridentata,* and juniper, *Juniperus occidentalis,* begin to appear, and other species of the open dry regions east of the Cascades; we are, in fact, almost before we can realize it, in the heart of the Arid Transition zone. Here at Sisters we are to remain for a few days to make a brief survey of the flora. Let us consider, therefore, a few of the most important physical features of the immediate locality where our observations are to be made.

The altitude of Sisters is a little over 1100 meters. It has an annual precipitation of 451 mm., of which a large part falls as snow. The summer temperature is never extremely high, and there are late spring and early autumn frosts; in fact, frosts are common in June. The town, of some four or five hundred, is situated on Squaw creek. This is a stream of some size, that takes its rise on the eastern slopes of the Three Sisters and flows in a northeasterly direction, to empty into Des Chutes river. During the summer practically the whole stream is diverted for irrigation.

The water of Squaw creek furnishes conditions favorable for a more varied plant life than is to be found in most localities in this part of the state. Though apparently along most of the stream's course the arid conditions prevail almost to the edge of the stream bed, there are in the neighborhood of Sisters some good sized meadows, swampy in places, and very narrow bottom

lands. To the southward of Sisters on the east side of the creek, there is a rather large tract of level country, portions of which are irrigated and under cultivation. The country to the northeast is rough and hilly. Everywhere there is an uneven growth of yellow pine and juniper (*Juniperus occidentalis*). In the cultivated sections the soil is fairly fertile, but over most of the area that came under our observation it is rather thin and poor, being made up largely of volcanic sand and gravel, with much loose rock in larger fragments, and occasional solid basaltic outcrops. The topographic and other conditions are thus seen to be sufficiently varied to give a fair idea of the general floral character of this part of the state.

It should be stated, before we proceed to a more detailed account of the species inhabiting the several areas studied, that the date (July 20-26) was too advanced to secure specimens of the short-lived vernal vegetation so characteristic of arid regions in our latitude. An examination showed, however, that this had not been particularly abundant.

In our present study we will arrange our species in four groups according to the moisture conditions of their habitat, viz., (1) species growing in water or saturated soil; (2) species of damp meadows and bottom lands; (3) species of level, moderately dry ground; (4) species of very dry, mostly hilly ground. Some of these groups, particularly (3) and (4) intergrade to a great extent, but we shall attempt to assign to each form its most characteristic habitat.

The first group consists of hydrophytes and subhydrophytes, most of which are of wide distribution. They are

Potamogeton pusillus	Salix sp.
Alopecurus geniculatus fulvus	Salix sp.
Eleocharis palustris	*Polygonum amphibium*
Carex utriculata	*Comarum palustre*
Carex sp.	*Sphaerosciadium capitellatum*
Carex sp.	*Cicuta occidentalis*
Carex sp.	*Veronica scutellata*
Juncus ensifolius major	*Veronica americana*

Of these sixteen species, at least half are of more or less general distribution over the United States, while probably three or four of the others occur on both sides of the Cascades. It is merely a Transition group, unaffected, of course, by the general aridity of the region.

The second group, plants of ordinary mesophytic conditions, includes the following:

Phleum pratense
Sporobolus sp.
Agrostis alba
Holcus lanatus
Deschampsia elongata
Poa pratensis
Poa compressa
Agropyron tenerum
Hordeum jubatum
Carex sp.
Juncus balticus
Juncus orthophyllus
Juncus regelii
Juncus badius
Hookera hyacinthina
Iris missouriensis
Sisyrinchium bellum
Sisyrinchium idahoense
Ibidium romanzoffianum
Betula sp.
Alnus tenuifolia
Alsine sp.
Ranunculus flammula repens
Ranunculus eiseni
Ranunculus oreganus macounii
Roripa obtusa
Ribes inerme (?)
Spiraea douglasii
Rubus macropetalus
Argentina anserina concolor
Amelanchier sp.
Lupinus polyphyllus
Melilotus albus
Trifolium longipes
Sidalcea oregana
Epilobium adenocaulon
Taraxia heterantha taraxacifolia
Pyrola incarnata
Gentiana acuta
Gentiana affinis
Gentiana simplex
Scutellaria galericulata
Castilleja miniata
Orthocarpus hispidus
Galium boreale
Lonicera coerulea
Agoseris glauca
Erigeron armeriaefolius
Aster campestris
Aster eatoni
Aster occidentalis
Aster sp.
Arnica sp.

Of these fifty-four species of mesophytes, nineteen are of very wide distribution and are mostly Transition forms; seven others are of general occurrence in Oregon, being found also on the west side of the Cascades.* Not over half of the total number are Arid Transition.

The third group, made up of species that grow mostly in moderately dry situations, comprises the following:

Pinus ponderosa
Pinus contorta
Abies nobilis
Gayophytum lasiospermum
Gayophytum diffusum
Gayophytum ramosissimum

*This expression, as used here and elsewhere, is meant to include mainly the Willamette valley, and not the Klamath Mountain region.

Pseudotsuga mucronata
Sporobolus depauperatus
Koeleria cristata
Elymus condensatus
Populus tremuloides
Polygonum erectum
Silene menziesii
Cerastium sp.
Ribes cereum
Philadelphus lewisii
Rosa pisocarpa
Potentilla biennis
Potentilla fastigiata
Horkelia fusca
Fragaria crinita
Drymocallis convallaria
Lupinus minimus
Lupinus laxiflorus
Phaca purshii
Vicia americana
Lathyrus bijugatus sandbergii
Linum digynum
Viola sp.
Epilobium paniculatum
Arctystaphylos manzanita
Gilia pharnaceoides
Gilia humilis
Collomia grandiflora
Collomia linearis
Phacelia linearis
Cryptanthe ambigua
Pentstemon confertus
Pentstemon collinus (?)
Pentstemon sp.
Mimulus nanus
Mimulus cusickii
Symphoricarpos racemosus
Ptiloria virgata
Agoseris heterophylla normalis
Hieracium griseum
Solidago missouriensis
Macheranthaera sp.
Hemizonella durandi
Achillea millefolium lanulosa
Artemisia ludoviciana
Senecio sp.
Antennaria geyeri

In this list of fifty-three species we find seven that have a very wide distribution, and eleven others that occur plentifully west of the Cascades, while several belong regularly to higher zones. Here, then, the dry region element is seen to predominate.

The fourth class, consisting of those species found mainly on very dry, stony hills, is necessarily more poorly represented in our list than the others, since it contains a greater proportion of delicate, short-lived forms that had disappeared before our arrival. We find here:

Juniperus occidentalis
Agropyron spicatum
Calochortus macrocarpus
Eriogonum proliferum
Eriogonum compositum
Eriogonum umbellatum
Silene sp.
Thelypodium laciniatum
Conanthus parviflorus
Lithospermum ruderale
Chrysothamnus viscidiflorus
Chrysothamnus puberulus
Chrysothamnus nauseosus
Townsendia florifer
Erigeron poliospermum
Erigeron linearis

Kunzia tridentata
Gilia pungens hookeri
Mentzelia albicaulis
Phacelia heterophylla
Phacelia sp.
Erigeron sp.
Eriophyllum multiflorum
Chaenactis douglasii
Artemisia tridentata
Senecio howellii

Of these twenty-six species none is of very general distribution and none is of more than exceptional occurrence west of the Cascades.

In summing up, we find that there are in all fifty-three species that are of very general distribution over the United States, or at least within this state, as they are found plentifully on both sides of the Cascades, and many of them in all the zones represented in Oregon except Hudsonian and Arctic. This wide range is due partly to great adaptability, partly to the moisture conditions under which they thrive. These forms are merely called Transition, but their presence here must be taken as of only minor significance in the determination of the zone.

Omitting those forms of uncertain identification, the rest fall into three groups, those characteristic of the Canadian, those of the Arid Transition, and those of the Upper Sonoran. The Canadian species are very few, and for the most part not abundantly represented by individuals. They are

Pinus contorta
Abies nobilis
Juncus regelii
Eriogonum umbellatum
Arctostaphylos manzanita
Gentiana simplex
Lonicera coerulea
Erigeron armeriaefolius

The position of one or two of these even is not very secure, as that of *Eriogonum umbellatum.*

As we might expect, it is impossible always to distinguish sharply between Arid Transition and Upper Sonoran zones, since they are not limited by any well marked physical features. So far as we can make out, the following are mainly Arid Transition forms:

Juniperus occidentalis
Pinus ponderosa
Agropyron spicatum
Juncus orthophyllus
Iris missouriensis
Sisyrinchium bellum
Sisyrinchium idahoense
Linum digynum
Sidalcea oregana
Taraxia heterantha taraxacifolia
Gayophytum lasiospermum
Gayophytum diffusum
Sphaerosciadium capitellatum
Cicuta occidentalis

Alnus tenuifolia
Ranunculus eiseni
Ranunculus oreganus macounii
Philadelphus lewisii
Potentilla biennis
Potentilla fastigiata
Horkelia fusca
Drymocallis convallaria
Argentina anserina concolor
Lupinus minimus
Lupinus laxiflorus
Trifolium longipes
Phaca purshii
Lathyrus bijugatus sandbergii
Gentiana affinis
Gilia humilis
Collomia linearis
Phacelia heterophylla
Lithospermum ruderale
Pentstemon confertus
Mimulus nanus
Ptiloria virgata
Agoseris glauca
Chrysothamnus puberulus
Solidago missouriensis
Aster eatoni
Senecio howellii
Antennaria geyeri

The species that are more characteristic, on the whole, of the Upper Sonoran are,

Sporobolus depauperatus
Elymus condensatus
Calochortus macrocarpus
Eriogonum proliferum
Eriogonum compositum
Thelypodium laciniatum
Kunzia tridentata
Mentzelia albicaulis
Gayophytum ramosissimum
Gilia pungens hookeri
Gilia pharnaceoides
Phacelia linearis
Conanthus parviflorus
Cryptanthe ambigua
Mimulus cusickii
Chrysothamnus viscidiflorus
Chrysothamnus nauseosus
Townsendia florifer
Erigeron poliospermum
Erigeron linearis
Aster campestris
Eriophyllum multiflorum
Chaenactis douglasii
Artemisia ludoviciana
Artemisia tridentata
Tetradymia canescens

But the merely numerical comparison of species does not give a full idea of the relative importance of the two groups in the general make-up of the flora. For example, the above named species of *Calochortus, Mentzelia, Gilia, Conanthus, Eriophyllum, Tetradymia,* and a number of others so abundant in the Upper Sonoran territory, here form an inconspicuous part of the flora, while sagebrush (*Artemisia tridentata*), which there lends color and character to almost the whole landscape, here assumes a much less prominent place, and the same is true, to a less marked degree, of the species of *Chrysothamnus.*

For the sake of comparison, let us consider much more briefly the flora of one other locality, namely, that of the neighborhood of the town of Bend, situated on Des Chutes river, about twenty-five miles southeast of Sisters.

The road between Sisters and Bend leads through a somewhat diversified region, parts of which are under cultivation, but much of it arid, stony and broken. Yellow pine and juniper are abundant but unevenly distributed, and sagebrush and rabbit bush (*Chrysothamnus*) are everywhere in evidence, though not dominating the landscape.

Only one day (July 27) was spent at Bend, which allowed but a very limited survey of the flora. In general it closely resembles that of the neighborhood of Sisters, but in regard to moisture the conditions are more severe. The elevation is a little greater, and the annual precipitation about 400 mm.

In the narrow strip of bottom land along Des Chutes river there is a copious vegetation of mesophytic species, including among forms not found at Sisters, *Monolepis nuttalliana, Monolepis spatulata, Ribes irriguum* (*?*), *Senecio triangularis,* and *Senecio* sp.

In the water and in mud along the margin of the stream were several widely distributed hydrophytes: *Potamogeton perfoliatus richardsonii, Anacharis canadensis, Carex aquatilis, Batrachium aquatile, and Callitriche verna.*

On land a little higher, but still affected to some extent by the proximity of the river, were found, in addition to many noted at Sisters, *Thelypodium* sp., *Lathyrus oregonensis, Rhus toxicodendron, Phacelia* sp., *Capnorea nana, Collinsia tenella,* and *Carduus undulatus.*

On the dry uplands sagebrush and rabbit bush predominate, with yellow pine and juniper, which have become less abundant as we have moved eastward. Here also we find *Festuca octoflora, Eriogonum vimineum, Delphinium depauperatum, Lupinus aridus,* and several others.

This brief discussion should serve to give some idea of the Arid Transition flora of central Oregon, though the area covered by the observations was too limited to yield a very extensive list of species, and the season too advanced for the early vegetation.

The following list includes practically all the species that were noted from the time we reached the eastern edge of the

lava fields until we left Bend. Brief notes regarding distribution, habit, relative abundance, etc., are added. Specimens of all but a few of the commonest were preserved.

Juniperus occidentalis Hook. First noted a little to the westward of Sisters, and increasing steadily in abundance to the Des Chutes (Bend).

Pinus monticola Dougl. Plentiful along the eastern edge of the lava fields, but thins out to the eastward and soon disappears.

Pinus ponderosa Dougl. The most abundant and characteristic tree of the Arid Transition. First appeared near the edge of the lava fields (elevation about 1300 m.) and continued abundant to the Des Chutes and eastward.

Pinus contorta Dougl. Common along the eastern margin of the lava fields, but thinning out and soon disappearing eastward. A single specimen found along Squaw creek at Sisters.

Abies nobilis Lindl. With the preceding and about equally common in our area. A specimen of this also was found at Sisters.

Pseudotsuga mucronata (Raf.) Sudw. Abundant for a short distance to the eastward of the lava fields, then fading out rather abruptly. A few specimens along Squaw creek.

Tsuga mertensiana (Bong.) Carr. Abundant along the eastern margin of the lava, but soon disappearing eastward.

Potamogeton perfoliatus richardsonii Benn. Abundant in Des Chutes river, covering the bottom over large areas.

Potamogeton pusillus L. Common in pools along Squaw creek, and in the Des Chutes.

Alisma plantago-aquatica L. Frequent in muddy ground along the Des Chutes.

Anacharis canadensis (Mich.) Planch. Abundant in the Des Chutes.

Oryzopsis hymenoides (R. & S.) Rick. Apparently not very plentiful, in high dry ground, Bend.

Alopecurus geniculatus fulvus (Smith) Sonder. Plentiful in moist meadows, Sisters.

Phleum pratense L. Abundant in damp meadows, Sisters.

Sporobolus depauperatus (Torr.) Scrib. In dry soil, Sisters. Only one or two specimens.

Sporobolus sp. A low, densely matted perennial found in one locality along Squaw creek.

Agrostis alba L. Abundant in damp meadows, Sisters, also along the Des Chutes.

Agrostis hyemalis (Walt.) B. S. P. A few specimens in damp ground along Squaw creek.

Holcus lanatus L. Common in damp meadows, Sisters.

Deschampsia elongata (Hook) Munro. In slightly moist places along the edge of the lava fields, and in damp ground along the Des Chutes.

Koeleria cristata (L.) Pers. Common in meadows, Sisters.

Poa pratensis L. Common in meadows, Sisters.

Poa compressa L. With the preceding; not so common.

Festuca octoflora Wald. Plentiful in dry ground, Bend.

Festuca pacifica Piper. In rather dry ground, Bend.

Festuca elatior L. A few specimens in damp ground along the Des Chutes.

Panicularia nervata (Willd.) Kuntze. Plentiful in wet ground along the Des Chutes.

Agropyron spicatum (Pursh.) Scribn. & Sm. Probably at one time bunch grass was more or less abundant over all this region, but close pasturage has nearly exterminated it here as in many other places. Sisters and Bend.

Agropyron tenerum Vas. Plentiful in meadows, Sisters.

Hordeum jubatum L. In meadows, Sisters.

Elymus condensatus Presl. Common in moderately dry ground, especially in "draws" and other depressions, Sisters.

Eleocharis palustris (L.) R. & S. Common in swampy meadows, Sisters, and along the Des Chutes.

Carex utriculata Boott. Swampy ground, Sisters and margin of the Des Chutes.

Carex lanuginosa Michx. Frequent in swampy meadows, Sisters.

Carex aquatilis Wahl. Found in one locality, in shallow water of the Des Chutes; a very tall, robust form.

Carex sp. In wet meadows, Sisters.

Carex sp. With the preceding.

Carex sp. With the preceding.

Carex sp. In dry ground, Sisters, and along the Des Chutes.

Juncus balticus Willd. Scarce; in moist meadows, Sisters.

Juncus orthophyllus Cov. Frequent in moist meadows, Sisters.

Juncus regelii Buch. With the preceding.

Juncus badius Suks. With the preceding; not common.

Juncus ensifolius major Hook. Infrequent; in swampy meadows, Sisters.

Hookera hyacinthina (Lindl.) Kuntze. In moist meadows, Sisters; apparently not very plentiful.

Calochortus macrocarpus Dougl. Found sparingly in very dry ground, Sisters.

Iris missouriensis Nutt. Frequent in moist meadows, Sisters, and along the Des Chutes.

Sisyrinchium bellum Wats. Plentiful in damp meadows, Sisters. Our material is somewhat doubtfully referred here. The species of this genus in Oregon are not very well understood.

Sisyrinchium idahoense Bick. Common in moist meadows, Sisters.

Ibidium romanzoffianum (Cham.) House. Infrequent; in moist meadows, Sisters.

Salix sp. In wet meadows and along the margin of Squaw creek.

Salix sp. With the preceding. These two willows form large clumps and extensive close thickets. They were not in a condition to be determined with certainty.

Populus tremuloides Michx. Plentiful in rather dry ground along Squaw creek. This is quite different from the eastern form, and perhaps distinct.

Betula microphylla Bunge. Common along the Des Chutes.

Betula sp. Common along Squaw creek. The species of Betula in Oregon are rather confused. Two forms seem to occur at Sisters, but they are possibly only extreme variations of the same species.

Alnus tenuifolia Nutt. Very plentiful along Squaw creek. An alder also occurs in abundance on the Des Chutes at Bend, but no specimens were collected. It is perhaps *A. rhombifolia* Nutt.

Rumex persicarioides L. In wet ground near the Des Chutes.

Polygonum erectum L. A few specimens in rather dry ground, Sisters.

Polygonum amphibium L. In a swampy meadow, Sisters.

Eriogonum proliferum T. & G. In very dry ground, Sisters and Bend; more common at the latter place.

Eriogonum vimineum Dougl. In dry ground, Bend; not abundant. A form with very minute flowers.

Eriogonum compositum Dougl. Rather common in dry ground, Sisters.

Eriogonum umbellatum Torr. Scarce; in very dry ground, Sisters. This form has a remarkable altitudinal range, occurring from Arid Transition to Arctic. It varies extremely in size, the high altitude forms being very dwarf. Our material is possibly the subspecies *majus* Benth.

Chaenopodium botrys L. Frequent in damp ground along the Des Chutes.

Monolepis spatulata Gray. Frequent in moist ground near the Des Chutes.

Monolepis nuttalliana (R. & S.) Greene. With the preceding, and about equally common.

Claytonia parviflora Dougl. Moist ground near Bend; one locality.

Silene menziesii Hook. A few specimens found in moderately dry ground at Sisters. The forms of this species found east of the Cascades have been variously set off as distinct. Our material represents a low bushy variety, with the leaves of the copious inflorescence greatly reduced.

Silene sp. Frequent in very dry ground, Sisters.

Cerastium sp. Several specimens found in rather dry ground at Sisters. A form resembling *C. nutans* Raf., but the petals and pedicels too short.

Alsine sp. Damp ground near Squaw creek; one locality. Possibly a form of *A. longipes* (Gold.) Cov.

Batrachium aquatile (L.) Wimm. Plentiful in the Des Chutes.

Ranunculus flammula reptans (L.) Sehl. Common in wet meadows, Sisters. Some of the specimens are strongly pubescent.

Ranunculus eiseni Kell. Infrequent; in moist ground, Sisters and Bend. Our material is referred doubtfully to this species of southern Oregon and northern California.

Ranunculus oreganus macounii (Britt.) Piper. Plentiful in wet meadows, Sisters.

Ranunculus cymbalaria Pursh. Frequent in wet ground along the Des Chutes.

Delphinium depauperatum Nutt. One specimen in very dry ground, Bend.

Roripa obtusa (Nutt.) Britt. One specimen found in damp ground near Squaw creek.

Thelypodium laciniatum (Nutt.) Endl. Dry stony ground at the foot of a cliff, Sisters.

Thelypodium sp. Found plentifully in one locality near the Des Chutes. A very small species for the genus.

Ribes inerme Ryd. (?) Plentiful in low thickets along Squaw Creek. Not fruiting.

Ribes irriguum Dougl. (?) Plentiful along the Des Chutes. Scarcely fruiting.

Ribes cereum Dougl. Frequent in dry ground, Sisters and Bend.

Philadelphus lewisii Pursh. Frequently in moderately dry ground, Sisters.

Spiraea douglasii Hook. In several localities in damp meadows, Sisters. This species is rare east of the Cascades. We should expect here *S. menziesii* Hook.

Rubus macropetalus Dougl. Common in damp ground along Squaw creek.

Rosa pisocarpa Gray. Common in somewhat dry grounds, Sisters.

Potentilla biennis Greene. Frequent in dry grounds, Sisters.

Potentilla fastigiata Nutt. Rather common in dry ground, Sisters and Bend.

Horkelia fusca Lindl. First noted in the yellow pine forest several miles to the west of Sisters, where over large areas it was almost the only herbaceous plant occurring in any abundance. Scarce at Sisters.

Fragaria crinita Ryd. In moderately dry ground, Sisters; rather scarce. *F. platypetala* Ryd. was found in the Cascades, Canadian zone, but it seems to be mainly an Arid Transition form, and is the one we should expect here. The species of *Fragaria* in Oregon are not well understood.

Argentina anserina concolor Ryd. Plentiful in wet meadows, Sisters, also along the Des Chutes.

Comarum palustre L. In a swampy meadow, Sisters.

Drymocallis convallaria Ryd. Common in rather dry ground, Sisters.

Kunzia tridentata (Pursh.) Spreng. Common on dry hills, Sisters and Bend.

Amelanchier sp. Common along Squaw creek. The material collected was in poor condition.

Lupinus aridus Dougl. Plentiful in dry ground, Bend.

Lupinus minimus Dougl. Frequent in dry ground, Sisters.

Lupinus polyphyllus Lindl. In wet meadows, Sisters; scarce. A small purple-flowered form.

Lupinus laxiflorus Dougl. Common in dry ground, Sisters.

Melilotus albus Desr. Common in moist ground, Sisters and Bend.

Trifolium longipes Nutt. Frequent in damp meadows, Sisters. A form with purple flowers.

Phaca purshii (Dougl.) Piper. In dry ground, Sisters; not common.

Vicia americana Muhl. A few specimens in moist ground near Squaw creek. A form approaching *V. a. linearis* (Nutt.) Wats.

Lathyrus oregonensis White. In dry ground, Bend; one locality.

Lathyrus bijugatus sandbergii White. Infrequent; in moderately dry ground, Sisters.

Linum digynum Gray. Scarce; in dry ground, Sisters.

Calitriche verna L. In pools along the Des Chutes.

Rhus toxicodendron L. In rather dry, stony ground, Bend; one locality.

Sidalcea oregana Gray. Moist meadows, Sisters; infrequent.

Hypericum scouleri Hook. Frequent in wet ground along the Des Chutes.

Viola sp. Abundant in one small area in sandy open ground, Sisters. A peculiar small, caulescent species, with cinerous-puberulent foliage and ovate leaves with repand margins. Not flowering.

Mentzelia albicaulis Dougl. Scarce; in high dry ground, Sisters.

Epilobium paniculatum Nutt. Common in rather dry ground, Sisters and Bend.

Taraxia heterantha taraxacifolia (Wats.) Small. A few specimens in moist ground along Squaw creek.

Gayophytum lasiospermum Greene. Common in dry ground, Sisters.

Gayophytum diffusum T. & G. With the preceding, but less common.

Gayophytum ramosissimum T. & G. With the preceding, frequent.

Sphaerosciadium capitellatum Gray. A few specimens in a swampy meadow, Sisters.

Cicuta occidentalis Greene. Scarce; in swampy meadows, Sisters.

Pyrola incarnata (DC.) Fisch. In one locality in damp shady ground along Squaw creek.

Arctostaphylos manzanita Parry. From the eastern border of the lava fields, through the yellow pine forest (where over large areas it is almost the only shrub), to Bend where it occurs sparingly. Though typically a Canadian species, it is thus seen to extend nearly across the Arid Transition.

Phyllodoce empetriformis (Smith) D. Don. Found sparingly, much out of its normal range, in a small canyon at the eastern edge of the lava fields.

Gentiana acuta Michx. Plentiful in damp meadows, Sisters, and along the Des Chutes.

Gentiana affinis Griseb. With the preceding and about equally common.

Gentiana simplex. Found sparingly in a wet meadow, Sisters. This seems an unusual locality for this species, which probably belongs to the Canadian zone, and has hitherto apparently been found only in the Sierra Nevada, Klamath, and Blue mountains.

Gilia pungens hookeri Gray. Scarce; on high dry ground, Sisters.

Gilia pharnaceoides Benth. Frequent in dry ground, Sisters and Bend.

Gilia humilis Greene. Infrequent; in moderately dry ground, Sisters and Bend.

Collomia grandiflora Dougl. Common in rather dry ground, Sisters.

Collomia linearis Nutt. Common in dry ground, Sisters and Bend.

Capnorea nana Raf. Moist ground, one locality, Bend.

Phacelia linearis (Pursh.) Holz. Rather plentiful in slightly moist ground, Sisters.

Phacelia heterophylla Pursh. In dry ground, Sisters; not common.

Phacelia sp. One specimen in dry ground, Sisters. Related to the preceding, but apparently distinct.

Phacelia sp. In one locality on a dry, stony hillside, Bend.

Related to *P. ramosissima* Dougl., and possibly a form of that species.

Conanthus parviflorus Greene. A few specimens in very dry ground, Sisters.

Cryptanthe ambigua (Gray) Greene. Frequent in rather dry ground, Sisters and Bend.

Lithospermum ruderale Dougl. A few specimens in high, dry ground, Sisters.

Scutellaria galericulata L. Scarce; in a damp meadow, Sisters.

Marrubium vulgare L. Common in dry ground, Bend.

Collinsia tenella (Pursh.) Piper. Moist ground, Bend; one locality.

Pentstemon glaber Pursh. Infrequent; in very dry ground, Bend.

Pentstemon confertus Dougl. Common in rather dry ground, Sisters and Bend.

Pentstemon collinus Nels.(?) Dry ground, Sisters and Bend; not common.

Pentstemon sp. Dry ground, Sisters.

Veronica americana Schw. Common in wet meadows, Sisters.

Veronica scutellata L. With the preceding.

Mimulus nanus H. & A. In moderately dry, sandy ground, Sisters and Bend. Extremely abundant in places, sometimes nearly covering the ground over an area of an acre or more, imparting a brilliant red color that may be seen for a distance of several miles.

Mimulus cusickii (Greene) Piper. In somewhat dry ground, Sisters; infrequent.

Castilleia miniata Dougl. In damp meadows, Sisters; not common.

Orthocarpus hispidus Benth. A few specimens in damp meadows, Sisters.

Chamaesaracha sp. A small colony representing an undetermined species of this genus was found in slightly moist, sandy ground along the Des Chutes.

Galium boreale L. Common in damp meadows, Sisters.

Galium trifidum subbiflorum Wieg. With the preceding.

Symphoricarpos racemosus Michx. Plentiful in rather dry ground, Sisters and Bend. A stout form, with thick glabrous leaves.

Lonicera involucrata Banks. In a small canyon at the eastern edge of the lava fields.

Lonicera coerulea L. A small colony at the edge of a meadow, Sisters.

Sambucus callicarpa Greene. A few specimens in the clefts of the rocks at the edge of the lava fields.

Valeriana sitchensis Bong. Plentiful in a small canyon at the edge of the lava fields. The subspecies *scouleri* (Ryd.) Piper, is found regularly in the Canadian and often in the Transition, while the type is Hudsonian. Our form is quite typical, and is therefore out of its normal range.

Ptiloria virgata (Benth.) Greene. Infrequent; in dry ground, Sisters.

Agoseris glauca (Nutt.) Greene. Rather scarce, in damp meadows, Sisters.

Agoseris heterophylla normalis Piper. Common in moderately dry ground, Sisters and Bend.

Hieracium griseum Ryd. Frequent in rather dry ground, Sisters.

Chrysothamnus puberulus Greene. High, dry ground, Sisters and Bend, more common at the latter place. This seems much to the westward of the regular range of the species.

Chrysothamnus viscidiflorus (Hook.) Nutt. High dry ground, plentiful at Sisters, very abundant at Bend.

Chrysothamnus nauseosus (Pall.) Britt. With the preceding and equally common. The two species are known as "Rabbit brush", and in the Upper Sonoran zone are second only to the sagebrush in abundance.

Solidago missouriensis Nutt. Frequent in moderately dry ground.

Townsendia florifer (Hook.) Gray. Frequent in dry ground, Sisters.

Erigeron poliospermus Gray. In dry ground, Sisters. Only one specimen found.

Erigeron linearis (Hook.) Piper. Frequent in very dry ground, Sisters and Bend.

Erigeron armeriaefolius Turez. A high altitude species of the Blue and Rocky mountains, and the Sierras, seemingly not hitherto known from the Cascade region.

Erigeron sp. In dry ground, Sisters; one specimen. A form resembling *E. hispidissimus* (Hook.) Piper, but with the pubescence short and soft and the rays much narrower.

Aster campestris Nutt. In meadows, Sisters; apparently not common.

Aster eatoni (Gray) Howell. With the preceding; not very common.

Aster occidentalis Nutt. With the preceding, common.

Aster sp. With the preceding.

Machaeranthera sp. Dry ground, Sisters and Bend; not common.

Hemizonella durandi Gray. A few specimens in rather dry ground, Sisters.

Eriophyllum multiflorum (Nutt.) Ryd. Infrequent in very dry ground, Sisters.

Eriophyllum lanatum (Pursh.) Forbes. A few specimens in dry ground, Bend.

Chaenactis douglasii (Hook.) H. & A. Very dry ground, Sisters; apparently scarce.

Achillea millefolium lanulosa (Nutt.) Piper. Frequent in dry ground, Sisters. A densely lanate form.

Artemisia ludoviciana Nutt. Common in dry ground, Sisters.

Artemisia tridentata Nutt. Sagebrush was first noted a little to the west of Sisters. It steadily increases eastward, and a few miles east of Bend, where the yellow pine disappears, it becomes the dominant species.

Tetradymia canescens DC. One specimen on high dry ground, Sisters.

Arnica sp. In damp meadows, Sisters; scarce.

Senecio howellii Greene. Common; in dry ground, Sisters and Bend.

Senecio triangularis Hook. A few specimens on the margin of the Des Chutes. It is rather suprising to find this Canadian and Hudsonian species in this locality. Our material represents a very tall and robust form.

Senecio sp. In rather dry ground, Sisters; one locality.

Senecio sp. One specimen of a small undetermined species found in damp ground, Bend.

Antennaria geyeri Gray. In moderately dry ground, Sisters; scarce.

Carduus undulatus Nutt. On a rather dry hillside, Bend.

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